

CLAIMS

What is claimed is:

- 5 1. A system for automating review of capture verification by a
medical practitioner, the system being configured for use with an
implantable stimulation device implanted in a patient and a programmer
operated by the medical practitioner and configured to remotely
communicate with the implantable stimulation device, the system
10 comprising:
autocapture means for performing automatic capture verification
through the implantable stimulation device to detect a presence
of a captured cardiac event and an absence of a captured
cardiac event when the captured cardiac event is expected;
15 control means for generating a visual representation of the
presence and absence of the captured cardiac event; and
display means for displaying the visual representation to the
medical practitioner, to permit the medical practitioner to
examine and analyze the performance of the automatic capture
20 verification.
2. The system of claim 1, further comprising:
first selection means, operatively coupled to the autocapture
means, for selecting one of an atrial and a ventricular chamber
25 of the patient's heart at which the capture verification is
performed.
3. The system of claim 1, wherein:
the autocapture means comprises a plurality of unique means for
30 automatic capture verification; and
the system further comprises second selection means, operatively
coupled to the autocapture means, for selecting a particular one

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of the unique automatic capture verification means for performing the automatic capture verification.

4. The system of claim 1, wherein:

5 the autocapture means further comprises means for detecting a plurality of additional cardiac events occurring during the automatic capture verification, and
the control means further comprises means for identifying the plurality of additional cardiac events in the visual
10 representation.

5. The system of claim 4, wherein the plural additional cardiac events comprise physiological atrial and ventricular events.

15 6. The system of claim 1, wherein the control means further comprises:
means for identifying in the visual representation a plurality of pacing events occurring during the automatic capture verification.
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7. The system of claim 6, wherein the plural pacing events comprise atrial and ventricular pacing pulses.

8. The system of claim 7, wherein:
25 each of the plural pacing events comprise amplitude and duration characteristics; and
the control system further comprises means for recording, in the visual representation, the amplitude and duration characteristics for the each pacing event of the plurality of pacing events.
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9. The system of claim 1, wherein the control means further comprises:

means for marking the captured cardiac event in the visual
representation with a visual marker representative of capture;
and

means for marking absence of the captured cardiac event with a
visual marker representative of absence of capture in a location
in the visual representation where the captured cardiac event
was expected to occur.

10. The system of claim 1, further comprising:

means for automatically assessing a pacing threshold value of the
implantable stimulation device;

means for adding a suitable safety margin to the pacing threshold
value to determine recommended pacing amplitude and pulse
width; and

means for displaying the recommended pacing amplitude and
pulse width.

11. The system of claim 10, further comprising:

third selection means operable for selectively activating the
autothreshold means from the programmer.

12. The system of claim 10, wherein:

the control means further comprises means for generating an
additional visual representation of the pacing threshold
assessment; and

the additional visual representation is displayed to the medical
practitioner on the display means, to permit the medical
practitioner to examine and analyze the performance of the
automatic pacing threshold assessment.

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13. The system of claim 1, further comprising:
printing means operatively coupled to the control means for
generating a printed copy of the visual representation.

5 14. The system of claim 12, further comprising:
printing means operatively coupled to the control means for
generating a printed copy of the additional visual
representation.

10 15. A system for automating review of capture verification by a
medical practitioner, the system being configured for use with an
implantable stimulation device implanted in a patient and a programmer
operated by the medical practitioner and configured to remotely
communicate with the implantable stimulation device, the system
15 comprising:
autocapture means for performing automatic capture verification
through one of the implantable stimulation device or the
programmer;
detection means for detecting presence and absence of expected
20 cardiac events during the automatic capture verification;
control means for identifying a captured cardiac event when the
captured cardiac event is detected, and for identifying, when an
expected captured event is not detected, an absence of the
expected captured cardiac event;
25 marking means for marking each of the identified captured cardiac
events and the absence of the expected captured cardiac
events with a pre-determined corresponding visual
representation; and
display means for displaying the visual representation to the
30 medical practitioner to permit the medical practitioner to
examine and analyze the performance of the automatic capture
verification.

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16. A method for automating review of capture verification by a medical practitioner, the method being implemented in an implantable stimulation device implanted in a patient and a programmer operated by the medical practitioner and configured to remotely communicate with the implantable stimulation device, the method comprising the steps of:

performing an automatic capture verification through one of the implantable stimulation device or the programmer by adjusting the stimulation device's stimulation pulse energy and by detecting a presence and absence of an expected captures cardiac events;

generating a visual representation of the automatic capture verification on an output device located in the programmer, the visual representation being configured to identify a presence of the captured cardiac events when the captured cardiac event is detected, and to identify an absence of the expected captured cardiac event when the cardiac event is not detected.

17. The method of claim 16, wherein the step of performing automatic capture verification through one of the implantable stimulation device or the programmer, further comprising the steps of:

obtaining an intracardiac electrogram through the implantable stimulation device; and

performing the automatic capture verification using the intracardiac electrogram.

18. The method of claim 16, wherein the step of performing automatic capture verification through one of the implantable stimulation device or the programmer, further comprising the steps of:

obtaining an surface electrocardiogram through the programmer; and

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performing the automatic capture verification using the surface electrocardiogram.

5 19. The method of claim 16, further comprising the steps of:
recording, in the visual representation, the amplitude and duration characteristics for each pacing event.

10 20. The method of claim 19, further comprising the steps of:
marking the captured cardiac event in the visual representation with a visual marker representative of capture; and
marking the absence of the captured cardiac event with a visual marker representative of absence of capture in a location in the visual representation at which the captured cardiac event was expected to occur.

15 21. The method of claim 20, further comprising the step of:
automatically assessing a pacing threshold of the implantable stimulation device;
determining a recommended pulse amplitude and pulse width
20 above the pacing threshold to ensure capture; and
displaying the recommended pulse amplitude and pulse width on the programmer.

25 22. A method for automating review of capture verification by a medical practitioner, the method being implemented in an implantable stimulation device implanted in a patient and a programmer operated by the medical practitioner and configured to remotely communicate with the implantable stimulation device, the method comprising the steps of:
30 (a) selectively initiating automatic capture verification by the medical practitioner;
(b) performing automatic capture verification through the implantable stimulation device;

- 5 (c) detecting, by at least one of the implantable stimulation device and the programmer, presence of cardiac events and absence of expected cardiac events during the automatic capture verification;
- 10 (d) identifying, by at least one of the implantable stimulation device and the programmer, a captured cardiac event when the captured cardiac event is detected, and when an expected capture event is not detected, identifying an absence of the expected captured cardiac event;
- 15 (e) marking, by at least one of the implantable stimulation device and the programmer, at least one of the identified captured cardiac event, and the absence of the expected captured cardiac event with a pre-determined corresponding event marker;
- 20 (f) generating, by at least one of the implantable stimulation device and the programmer, a visual representation of the identified cardiac events and the event markers; and
- (g) displaying, at the programmer, the visual representation to the medical practitioner to permit the medical practitioner to examine and analyze the performance of the automatic capture verification.

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